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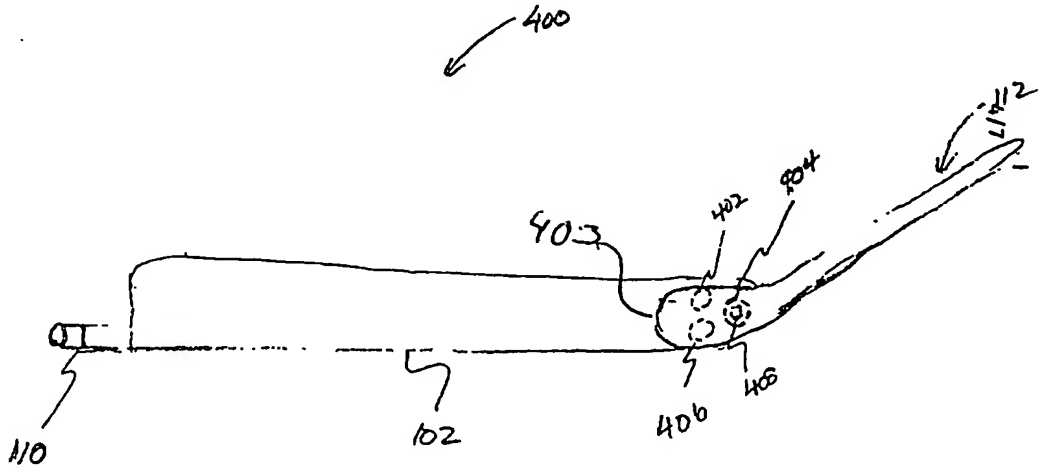

(57) Abstract

A communications device that operates as a combination flip telephone and personal digital assistant (PDA). The opening and closing of the flip cover activates a switch that changes the operating mode of the communications device. The communications device operates as a combination wireless telephone and personal digital assistant (PDA) when the flip cover is open. This is called the SMARTPHONE mode of operation. When the flip cover is closed, the communications device operates as a standard wireless telephone. This is known as the KEYPAD mode of operation.

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FLIP PHONE WITH PDA AND MODE SELECTION

BACKGROUND OF THE INVENTION

I. Field of the Invention

The present invention relates generally to the field of mobile communications, and more particularly, to a combination flip phone and personal digital assistant (PDA) that changes the mode of operation by opening and closing the flip cover.

II. Related Art

Many mobile communications devices are now combining wireless phone technology with hand-held computer platforms that provide personal information management. Such hand-held computer devices are called personal digital assistants (PDAs). Combination mobile communications devices usually operate as two separate instruments, requiring separate liquid crystal displays (LCDs) and additional circuitry to read the separate input devices of the wireless phone and the PDA.

Matrix encoded keyboards and keypads are used extensively as input devices for computers and telephones. Such keyboards and keypads are usually mounted on a flex circuit and require multiple signal paths (that is, wires or conductive traces) to detect which key is pressed. For example, a 4 by 4 matrix keypad, which contains sixteen input keys, requires eight signal paths. When the keyboard or keypad is implemented on a flip cover, as may be the case with a wireless phone or PDA, multiple signal paths are routed to the body of the communications device through a hinge. The routing of multiple signal paths through a hinge causes the instrument to be less durable and may lead to the breakage of the hinge or the flex circuit if the instrument is constantly picked up by grasping the flip cover.

Many PDAs require a two-channel analog-to-digital converter (ADC) to read the touch panel display. When the PDA is combined with a wireless telephone that implements the keypad on a flip cover, additional circuitry usually includes an additional ADC to read the keypad on the flip cover and an additional LCD for the wireless telephone display.

What is needed is an efficient and cost effective way to integrate a PDA and wireless telephone with a flip cover that is lightweight, durable, and easy to operate. What is further needed is the integration of a PDA and wireless telephone that provides a user-friendly mechanism for changing the mode of operation of the device.

SUMMARY OF THE INVENTION

The present invention satisfies the above mentioned needs by providing a communications device that efficiently integrates a flip telephone with a PDA. The present invention operates as a single unit. According to a first embodiment of the present invention, the opening and closing of the flip cover activates a switch that changes the operating mode of the communications device. The communications device operates as a combination wireless telephone and personal digital assistant (PDA) when the flip cover is open. This is called the SMARTPHONE mode of operation. When the flip cover is closed, the communications device operates as a standard wireless telephone. This is known as the KEYPAD mode of operation.

According to a second embodiment of the present invention, the flip cover and hinge operate as a rotary switch to select the mode of operation of the communications device. Multiple contacts are located on the sides of the inner surface of the flip cover and a single contact is located on each side of the body of the communications device . Each contact located on the sides of the inner surface of the flip cover represents a different mode of operation for the communications device. As the flip cover rotates from the closed position to its final position as a stand, the mode of operation of the communications device changes as the contact from the body of the communications device connects with one of the contacts on the flip cover. Three modes of operation are presently implemented: the KEYPAD mode, the SMARTPHONE mode, and the SPEAKERPHONE mode.

The third embodiment of the present invention is a detection circuit that detects the open and closed state of the flip cover. The detection circuit includes a resistive network and an analog-to-digital converter (ADC). When the flip cover is in the closed position, the circuit detects a unique resistive value through a set of contacts. This voltage level is converted from an analog signal to a digital signal via

the ADC for input into a microprocessor. When the flip cover is in the open position, the contacts are broken, thus, disabling the detection of the unique resistive value. The resulting voltage level is converted from an analog signal to a digital signal via the ADC for input into a microprocessor. Software, programmed within the microprocessor, enables the communications device to operate in the appropriate mode according to the detection of the open/close state of the flip cover.

Further features and advantages of the invention, as well as the structure and operation of various embodiments of the invention, are described in detail below with reference to the accompanying drawings.

BRIEF DESCRIPTION OF FIGURES

The features, objects, and advantages of the present invention will become more apparent from the detailed description set forth below when taken in conjunction with the drawings in which like reference characters identify corresponding elements throughout. In the drawings, like reference numbers generally indicate identical, functionally similar, and/or structurally similar elements. The drawings in which an element first appears is indicated by the leftmost digit(s) in the corresponding reference number.

FIG. 1 is a diagram illustrating the communications device with the flip cover in the closed position;

FIG. 2 is a diagram of an embodiment of the communications device with the flip cover in the open position;

FIG. 3 is a circuit diagram illustrating a mechanism for changing the mode of operation of the communication device using the flip cover;

FIG. 4 is a diagram of a side view of an embodiment of the present invention that employs multiple contacts on the side of the interior surface of the flip cover to determine the operating mode of the communications device;

FIG. 5 is a diagram of the communications device utilizing the flip cover as a stand;

FIG. 6 is a circuit diagram illustrating mode selection using the contacts located on the side of the interior surface of the flip cover; and

FIG. 7 is a circuit diagram illustrating the detection of the open and close state of the flip cover.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

While the present invention is described herein with reference to illustrative embodiments for particular applications, it should be understood that the invention is not limited thereto. Those skilled in the art with access to the teachings provided herein will recognize additional modifications, applications, and embodiments within the scope thereof and additional fields in which the present invention would be of significant utility.

The present invention is directed toward a communications device comprising a combination flip telephone and personal digital assistant (PDA). The present invention operates as a standard cellular telephone when the flip cover is in the closed position. This mode of operation is referred to as the KEYPAD mode. The present invention also operates as a PDA and telephone when the flip cover is in the open position. This mode of operation is referred to as the SMARTPHONE mode. A first embodiment of the present invention implements a switch that is controlled by the opening and closing of the flip cover to establish the modes of operation of the combination flip telephone and PDA. In a second embodiment of the present invention, the flip cover and hinge act as a rotary switch to control the selection of the mode of operation of the communications device. In a third embodiment, the detection of the open/close state of the flip cover is accomplished using a detection circuit that detects the presence of a resistive circuit.

Figure 1 illustrates a front view of a communications device **100** with the flip cover in the closed position, i.e., KEYPAD mode. Communications device **100** comprises a body **102** and a flip cover **112**. Body **102** comprises a liquid crystal display (LCD) **104**, a speaker **106**, a microphone **108**, and an antenna **110**. Flip cover **112** comprises a flip hinge **114**, an exterior surface **116**, and an interior surface **208** (shown in Figure 2). Flip hinge **114** is a jointed device that enables flip cover **112** to open and close by rotating flip cover **112** about flip hinge **114**. Flip hinge **114** also allows flip cover **112** to be removably detached

from the body 102 of the communications device 100. Exterior surface 116 of flip cover 112 contains a keypad 118. Keypad 118 is a standard telephone keypad that is well known in the relevant art(s).

When flip cover 112 is closed, only a portion of LCD display 104 is exposed. This portion of LCD display 104 is used to display various telephone functions, such as the date, time, redial function and a menu. Also displayed is a signal strength indicator and a digital indicator. The signal strength indicator indicates the strength of the signal being received via antenna 110. The digital indicator indicates that the telephone is operating in digital mode. Microphone 108 and speaker 106 are used to convert variations in sound pressure, i.e., voice, to variations in electrical signals or variations in electrical signals into variations in sound pressure, i.e., voice, respectively. Antenna 110 is used to receive and transmit signals being sent to and from communications device 100.

Figure 2 illustrates a front view of communications device 100 with the flip cover in the open position, i.e., SMARTPHONE mode. Body 102 of the communications device 100 displays a full view of LCD 104. The top portion of LCD 104 is used to display the functions of a telephone while the bottom portion of LCD 104 displays functions related to the PDA. Such functions include all of the personal management functions found on the Palm™ III organizer, such as date book, address book, to-do list, expense management, calculator, note-taking, and games, and e-mail, web, and Alert Manager functions. Body 102 of communications device 100 also contains PDA buttons 202, a first spring loaded pogo pin 204, and a second spring loaded pogo pin 206. PDA buttons 202 allow for user input into a microprocessor (shown in FIGs. 6 and 7). Notice that microphone 108 is exposed when flip cover 112 is in both the closed and open positions. This is due to the open rectangular space 122 at the bottom of flip cover 112.

Interior surface 208 of flip cover 112 contains a first contact 210 and a second contact 212. When flip cover 112 is in the closed position, first contact 210 electrically connects with first spring loaded pogo pin 204 and second contact 212 electrically connects with second spring loaded pogo pin 206 to allow for user input from keypad 118 to the microprocessor (shown in FIG. 7).

Flip Phone with PDA and Mode Selection

The present invention determines the operating mode of the flip telephone and PDA by activating a switch. The present invention activates the switch using flip cover 112 of the communications device 100. Figure 3 represents a diagram of a circuit 300 that detects the operating mode of communications device 100. Circuit 300 includes flip cover 112 and body 102 of communications device 100. Communications device 100 includes a switch 302, a microprocessor 304, and a pull-up resistor R. One end of switch 302 is connected to a ground 306. The other end of switch 302 is connected to microprocessor 304. Pull-up resistor R is connected to a voltage source V on one end and to microprocessor 304 and switch 302 on the opposite end. Voltage source V is approximately +3.3 volts and resistor R is approximately 100 K ohms. After reading the description, it will be apparent to a person skilled in the relevant art(s) to implement the invention using other values for V and R without departing from the spirit and scope of the invention.

Interior surface 208 of flip cover 112 includes a plastic piece 308. Plastic piece 308 engages switch 302 when flip cover 112 is in the closed position. When flip cover 112 is in the closed position, plastic piece 308 causes switch 302 to be in a closed position and thus pulls an operating mode indicator signal 310 to a low level. Plastic piece 308 disengages switch 302 when flip cover 112 is in the open position. When flip cover 112 is in the open position, the disengagement of plastic piece 308 causes switch 302 to open, and voltage source V, through pull-up resistor R, causes operating mode indicator signal 310 to input a high level into microprocessor 304. Operating mode indicator signal 310 indicates the present mode of operation of communications device 100 to microprocessor 304. When operating mode indicator signal 310 is true (high), it causes the software running on microprocessor 304 to operate communications device 100 in the SMARTPHONE mode. When operating mode signal 310 is false (low), it causes the software running on microprocessor 304 to operate communications device 100 in the KEYPAD mode. One skilled in the particular art(s) would be able to construct the software running on microprocessor 304 with ease.

Selecting Flip Telephone Operating Mode Using the Flip Position

One can also engage different modes of operation for communications device **100** based on the position of flip cover **112**. In another embodiment of the present invention, shown in FIG. 4, the flip cover and the hinge act as a rotary switch to control the selection of the mode of operation of communications device **100**. Multiple contacts are positioned on the sides of interior surface **208** of flip cover **112** while a single contact is positioned on both sides of body **102** of communications device **100**. As flip cover **112** rotates about hinge **114**, the contacts on the inside of flip cover **112** make a connection with the contacts on the side of body **102** of communications device **100**, each connection indicating a different mode of operation. In the preferred embodiment, three contacts are positioned on each side of interior surface **208** of flip cover **112**. The three modes of operation represented by the three contacts **402, 404**, and **406** are KEYPAD mode, SMARTPHONE mode, and SPEAKERPHONE mode, respectively. One skilled in the relevant art(s) will recognize that the multiple contacts could be placed on body **102** of communications device **100** and a single contact could be placed on each side of the inside of flip cover **112** without departing from the scope of the present invention.

FIG. 4 is a side view of an embodiment of the present invention that enables different modes of operation based on the position of flip cover **112**. The inside of flip cover **112** contains three contacts **402, 404**, and **406** (shown in phantom as circles) on one side and three contacts **610, 612, 614** (shown in Figure 6) on the opposite side. A contact **408** (shown in phantom as a square) is found on body **102** of communications device **100**. Another contact **616** (shown in Figure 6) is positioned on the opposite side of body **102** of communications device **100**. With this embodiment, the present invention operates as a standard telephone in the KEYPAD mode, a PDA and telephone in the SMARTPHONE mode, and a speaker phone in the SPEAKERPHONE mode. Flip contacts **402** and **610** make connections with contacts **408** and **616**, respectively, when flip cover **112** is in the closed position. This connection indicates the KEYPAD mode of operation. Flip contacts **404** and **612** make connections with contacts **408** and **616**, respectively, when flip cover **112** is in the open position. This

connection indicates the SMARTPHONE mode of operation. When flip contacts 406 and 614 connect with contacts 408 and 616, respectively, the mode of operation is SPEAKERPHONE mode. In SPEAKERPHONE mode flip cover 112 is folded all the way back so that flip cover 112 operates as a stand. When communications device is in SPEAKERPHONE mode, the volume of communications device 100 increases, indicating that the instrument is on the stand as opposed to being in the handheld configuration, against the side of one's face. Figure 5 represents communications device 100 with flip cover 112 positioned as a stand.

The circuitry that enables mode selection when contacts 402-408 and 610-616 are located on the side of flip cover 112 and communications device 100 is shown in Figure 6. Circuit 600 includes circuitry from flip cover 112 and circuitry from body 102 of communications device 100. The circuitry from flip cover 112 connects with the circuitry from body 102 of communications device 100 via contacts 402, 404, 406, and 610 on flip cover 112 with contacts 408 and 616 on body 102 of communications device 100.

The circuitry found on flip cover 112 includes keypad 118 connected to contacts 610-614 and a resistor R13 on one side of keypad 118 and to contact 402 and a resistor R14 on the other side of keypad 118. The other side of resistor R13 is connected to contact 406. The other side of resistor R14 is connected to contact 404. Contacts 610, 612, and 614 are tied together.

The circuitry for keypad 118 is a resistive ladder network. The resistive ladder network for keypad 118 includes a plurality of keys 602 connected to a plurality of resistors 604. Each key 602 is connected to one resistor 604. Each key 602 is also implemented as a switch. When a given key 602 is pressed, the resistance 604 associated with that key 602 provides a unique voltage level representing the pressed key 602 that distinguishes the pressed key 602 from another key 602.

When flip cover 112 is positioned so that contacts 610 and 402 connect to body 102 of communications device 100, communications device 100 operates in keypad mode. The resistance associated with each key 602 is the corresponding resistance 604 directly connected to the key 602 that is pressed. For example, the resistive value associated

with key K1 is resistor R1, key K2 is resistor R2, key K3 is resistor R3, and so on.

When flip cover 112 is positioned so that contacts 612 and 404 connect to body 102 of communications device 100, communications device 100 operates in the SMARTPHONE mode. The resistance associated with each key 602 is the corresponding resistance 604 directly connected to the key 602 that is pressed and the series resistance R14. For example, the resistive value associated with key K1 is resistor R1 in series with resistor R14, key K2 is resistor R2 in series with resistor R14, key K3 is resistor R3 in series with resistor R14, and so on. Thus, R14 acts as a bias by supplying an offset to keypad 118. Unless a key 602 is pressed, R14 does not come into play. When a key 602 is pressed, R14 moves the entire keypad 118 into a different range on an analog-to-digital converter 606 (shown in body 102 of communications device 100). The present embodiment, therefore, allows input from keypad 118 when communications device 100 operates in SMARTPHONE mode.

When flip cover 112 is positioned so that contacts 614 and 406 connect to body 102 of communications device 100, communications device 100 operates in the SPEAKERPHONE mode. When communications device 100 operates in the SPEAKERPHONE mode, keypad 118 is taken out of the loop, and the resistive value is now resistor R13.

The values of resistors R1 through R12 are chosen to give a unique voltage reading for each key 602 on keypad 118. R13 and R14 are also chosen to give a unique voltage reading when communications device 100 operates in SPEAKERPHONE mode or when keys 602 are pressed and communications device 100 is operating in SMARTPHONE mode, respectively.

The circuitry from body 102 of communications device 100 includes contacts 616 and 408, analog-to-digital converter (ADC) 606, a microprocessor 608, a PNP transistor 620, and two resistors R15 and R16. Contact 408 is connected to ground. Contact 616 is connected to ADC 606 and resistor R15. Contact 616 supplies the signal from flip cover 112 to ADC 606. ADC 606 is connected to microprocessor 608. ADC 606 digitizes the analog signal for input into microprocessor 608. Microprocessor 608 outputs a signal called PWR KEYPAD to the base

of PNP transistor 620 via resistor R16. PWR KEYPAD allows microprocessor 608 to turn the power to keypad 118 on and off. The emitter of PNP transistor 620 is connected to a voltage source V_S. V_S is typically +3.3 volts, but may vary from application to application. The collector of PNP transistor 620 is connected to the other end of resistor R15.

In an alternative embodiment, R14 is located in body 102 of communications device 100.

In operation, software running on microprocessor 608 enables PWR KEYPAD to output a high voltage level to the base of PNP transistor 620 through resistor R16 to turn on PNP transistor 620. When the PNP transistor is turned on, current flows from voltage source V_S through PNP transistor 620 to supply power to keypad 118. Resistor R15 is used to divide the signal being sent from flip cover 112 for input to ADC 606. Depending upon which contacts from flip cover 112 circuitry connect to the contacts on body 102 of communications device 100 determines which signal is processed by ADC 606 to be read by microprocessor 608. If flip cover 112 is detached from body 102 of communications device 100, ADC 606 would receive as input the voltage signal from V_S minus the voltage drop from the emitter to the collector of PNP transistor 620 and the voltage drop across resistor R15. Microprocessor 608, via software running on microprocessor 608, determines the mode of operation from the distinct voltage levels associated with each mode of operation.

Detection of Flip Closure State of a Flip Telephone

The detection of the open/close state of flip cover 112 of communications device 100 is shown in Figure 7. Circuit 700 includes circuitry from flip cover 112 and circuitry from body 102 of communications device 100. The circuitry from flip cover 112 electrically connects with the circuitry from body 102 of communications device 100 when flip cover 112 is in the closed position. First contact 210 electrically connects with first spring loaded pogo pin 204 and the second contact 212 electrically connects with second spring loaded pogo pin 206 to allow for user input from keypad 118 to a microprocessor 708.

The circuitry found on flip cover 112 includes keypad 118 connected to first contact 210 and resistor R13 on one side of keypad 118 and to second contact 212 and the other end of resistor R13 on the other side of keypad 118. The circuitry for keypad 118 is a resistive ladder network. The resistive ladder network for keypad 118 includes a plurality of keys 702 connected to a plurality of resistors 704. Each key 702 is connected to one resistor 704. Each key 702 is also implemented as a switch. When a given key 702 is pressed, the resistance 704 associated with that key 702 provides a unique voltage level representing the pressed key 702 that distinguishes the pressed key 702 from any other key 702.

The circuitry from body 102 of communications device 100 includes first and second spring loaded pogo pins 204 and 206, an analog-to-digital converter (ADC) 706, microprocessor 708, a PNP transistor 720, and two resistors R14 and R15. The second spring loaded pogo pin 206 is connected to ground. First spring loaded pogo pin 204 is connected to ADC 706 and resistor R15. First spring loaded pogo pin 204 supplies the signal from flip cover 112 to ADC 706. ADC 706 digitizes the analog signal in order that the signal may be read by microprocessor 708. The microprocessor outputs a signal called PWR KEYPAD to the base of PNP transistor 720 via resistor R14. PWR KEYPAD allows microprocessor 708 to control keypad 118 by turning the power to keypad 118 on and off. The emitter of PNP transistor 720 is connected to a voltage source V_S. V_S is typically +3.3 volts, but may vary from application to application. The collector of PNP transistor 720 is connected to the other end of resistor R15.

In operation, software running on microprocessor 708 enables PWR KEYPAD to output a high voltage level to the base of PNP transistor 720 through resistor R14 to turn on PNP transistor 720. When PNP transistor 720 is turned on, current flows from the voltage source V_S through PNP transistor 720 to supply power to keypad 118. Resistor R15 is used to divide the signal being sent from flip cover 112 for input to ADC 706. When flip cover 112 is closed and no keys 702 are pressed, the voltage at contact 210 is a unique voltage based on the voltage drop across R13. This allows microprocessor 708 to detect that flip cover 112 is closed based on only the value of resistance R13 across the circuit. When a key 702 is pressed, the resistance associated with

the pressed key 702 is resistor 704 in parallel with resistor R13. For example, the resistive value associated with key K1 is R1 in parallel with R13, key K2 is R2 in parallel with resistor R13, key K3 is R3 in parallel with resistor R13, and so on.

The values of resistors R1 through R12 are chosen to give a unique resistance value for each key 702 on keypad 118. R13 is also chosen to give a unique resistance reading when no keys 702 are pressed. When flip cover 112 is in the open position or detached from body 102 of communications device 100, ADC 706 receives as input the voltage signal from V_S minus the voltage drop from the emitter to the collector of PNP transistor 720 (V_{EC}) and the voltage drop across resistor R15 (V_{R15}). Microprocessor 708, via software executing on microprocessor 708, detects the open/close state of flip cover 112 based on the distinct voltage levels associated with the position of flip cover 112.

Conclusion

While the present invention is described in terms of a combination flip phone and PDA, the present invention is also applicable to other multi-functional portable devices that employ a flip cover. The previous description of the preferred embodiments is provided to enable any person skilled in the art to make or use the present invention. While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention.

We Claim:

CLAIMS

1. A mechanism for changing the modes of operation of a communications device, comprising:

a body having

a switch, and

a microprocessor coupled to said switch; and

a flip cover, rotatably coupled to said body, having a mechanical means for opening and closing said switch, wherein the closure of said switch results in a first mode of operation for said communications device and the opening of said switch results in a second mode of operation for said communications device.

2. The mechanism of claim 1, wherein said communications device is a combination flip phone and personal digital assistant and said flip cover comprises a keypad.

3. The mechanism of claim 2, wherein said first mode of operation is KEYPAD mode.

4. The mechanism of claim 2, wherein said second mode of operation is SMARTPHONE mode.

5. The mechanism of claim 3, wherein said KEYPAD mode causes said communications device to operate as a wireless telephone.

6. The mechanism of claim 4, wherein said SMARTPHONE mode causes said communications device to operate as a wireless telephone and personal digital assistant.

7. An apparatus for changing the mode of operation of a device, comprising:

a first portion having a non-conductive member;

a second portion having a switch coupled to a resistive circuit and a microprocessor; and

a hinge connected to said first and second portion to allow said first portion to rotate around said second portion;

wherein said non-conductive member is positioned to close said switch when said first portion engages said second portion, thereby pulling a mode indication signal to a low level, and wherein said non-conductive member causes said switch to open when said first portion disengages said second portion, thereby causing said resistive circuit to pull said mode indication signal to a high level, wherein said microprocessor causes said device to operate in a first mode when said mode indication signal is low and in a second mode when said mode indication signal is high.

8. The apparatus of claim 7, wherein said first portion further comprises a keypad and said second portion is a combination phone and personal digital assistant.

9. The apparatus of claim 8, wherein said first mode of operation is KEYPAD mode.

10. The apparatus of claim 8, wherein said second mode of operation is SMARTPHONE mode.

11. The apparatus of claim 9, wherein said KEYPAD mode causes said device to operate as a standard telephone.

12. The apparatus of claim 10, wherein said SMARTPHONE mode causes said device to operate as a telephone and personal digital assistant.

13. A system for changing the operating mode of a device, comprising:

switching means, having an open and closed state, for causing a mode indication signal to change state;

control means for enabling a flip having a mechanical means to control said open and closed state of said switching means, wherein the closure of said switching means pulls said mode indication signal to a low state;

resistive means for enabling said mode indication signal to be pulled to a high state when said switching means is in an open state; and

processor means for causing said device to operate in a first mode of operation based on said closed state of said switching means and in a second mode of operation based on said open state of said switching means.

14. The system of claim 13, wherein said flip is connected to said device through a hinge.

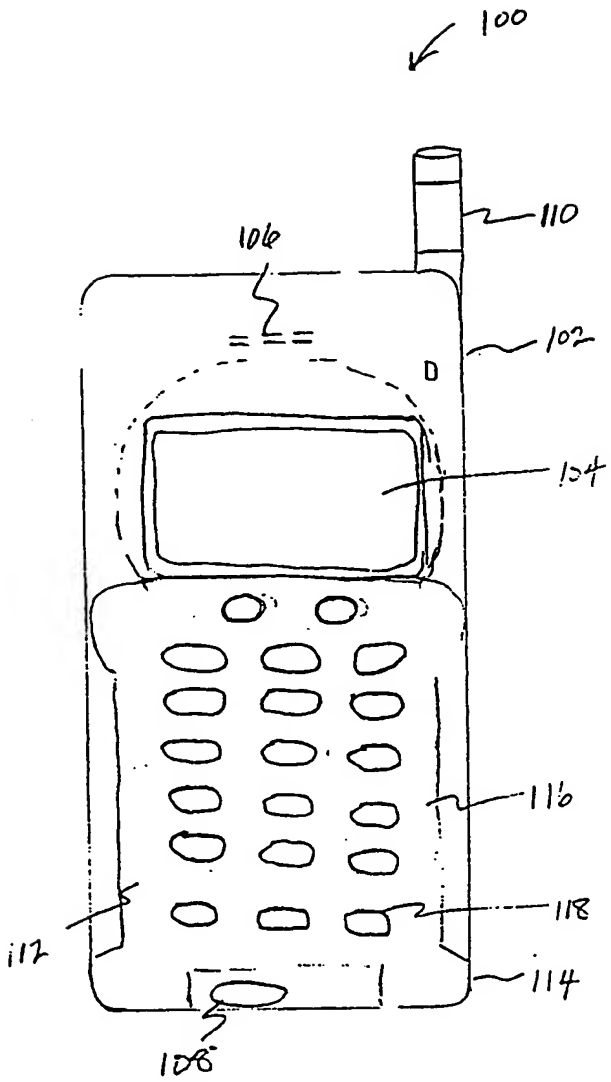


FIG. 1

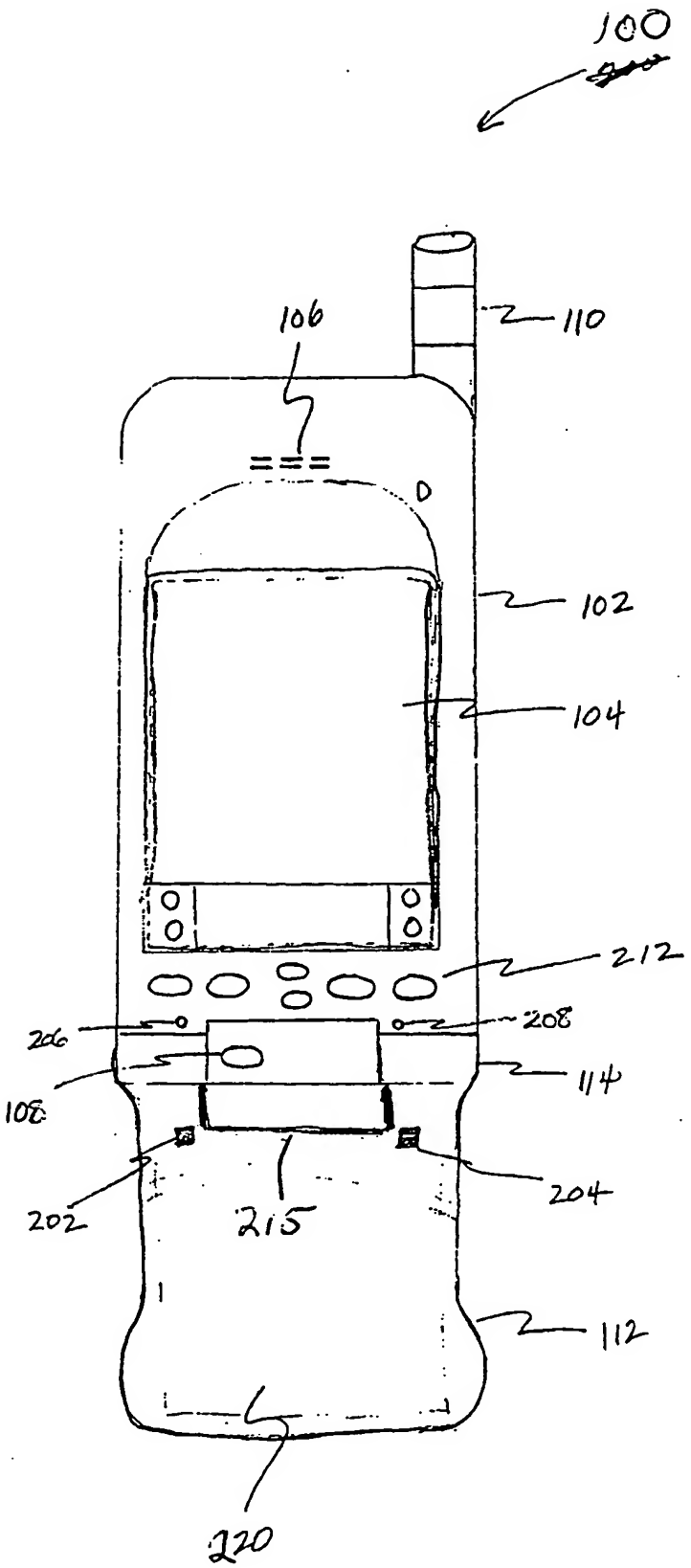


FIG. 2

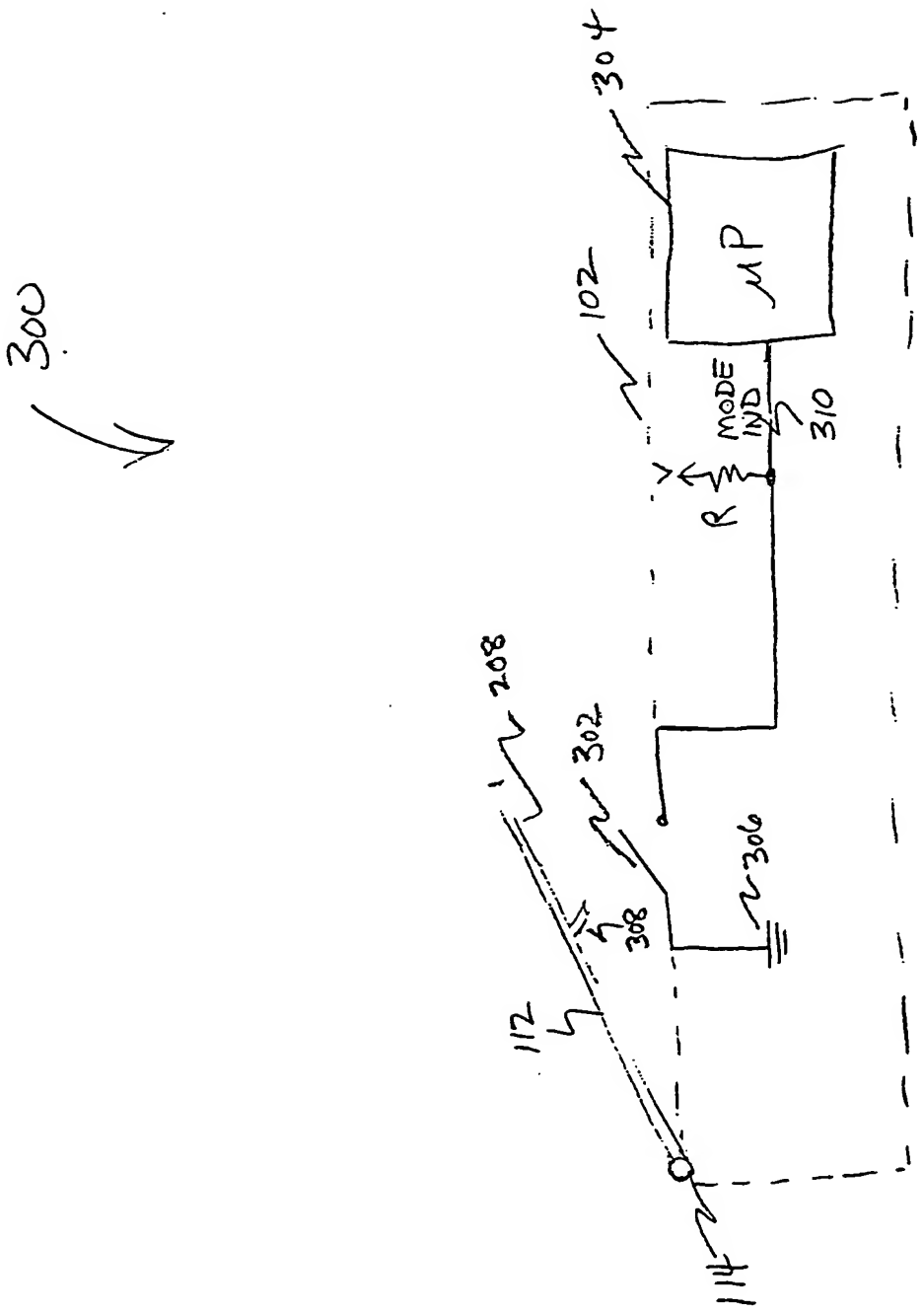


FIG. 3

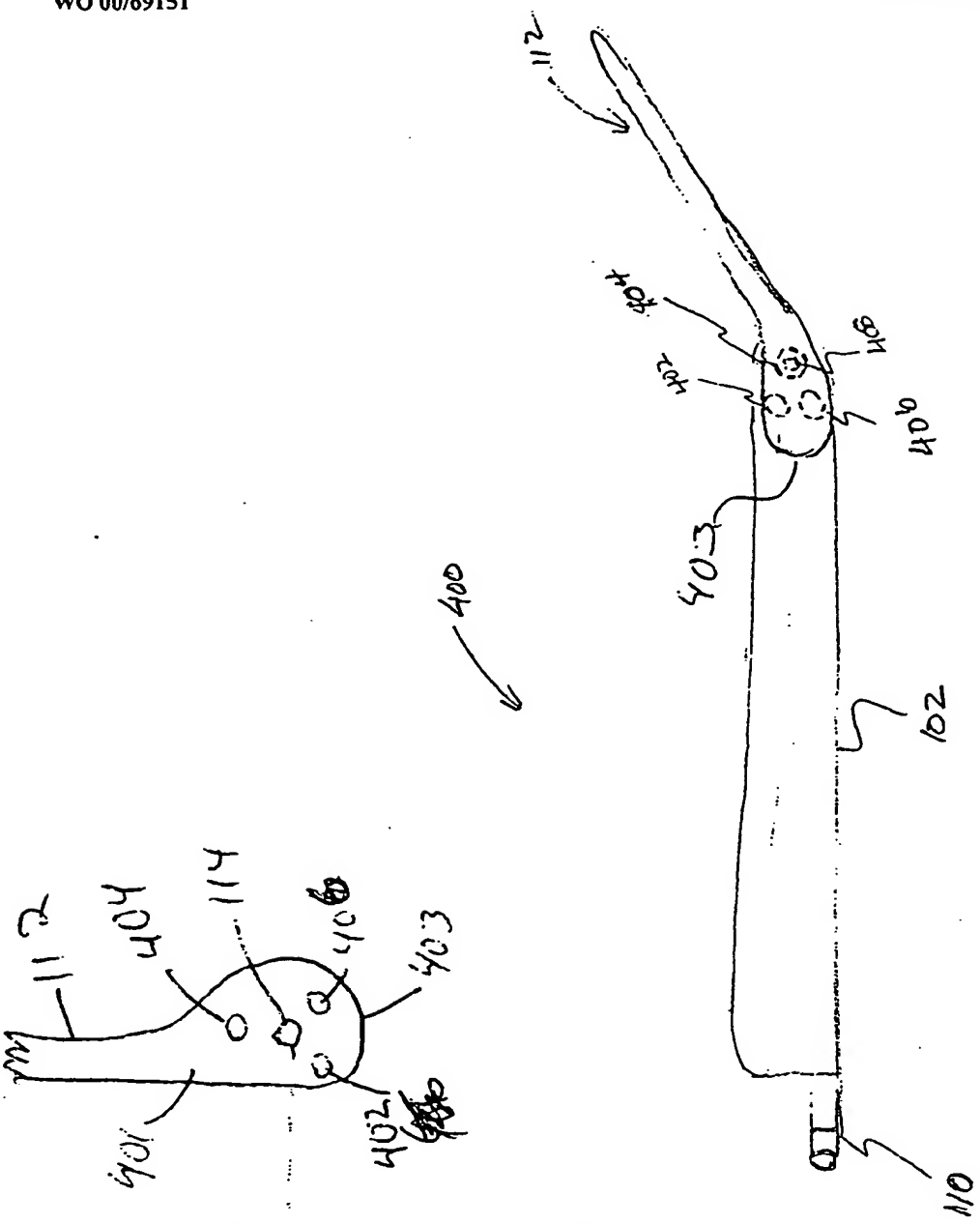

112
404
406
408
403
400
102
110

FIG 4

112
404
114
406
403
401
402
408
114
102

FIG. 4a

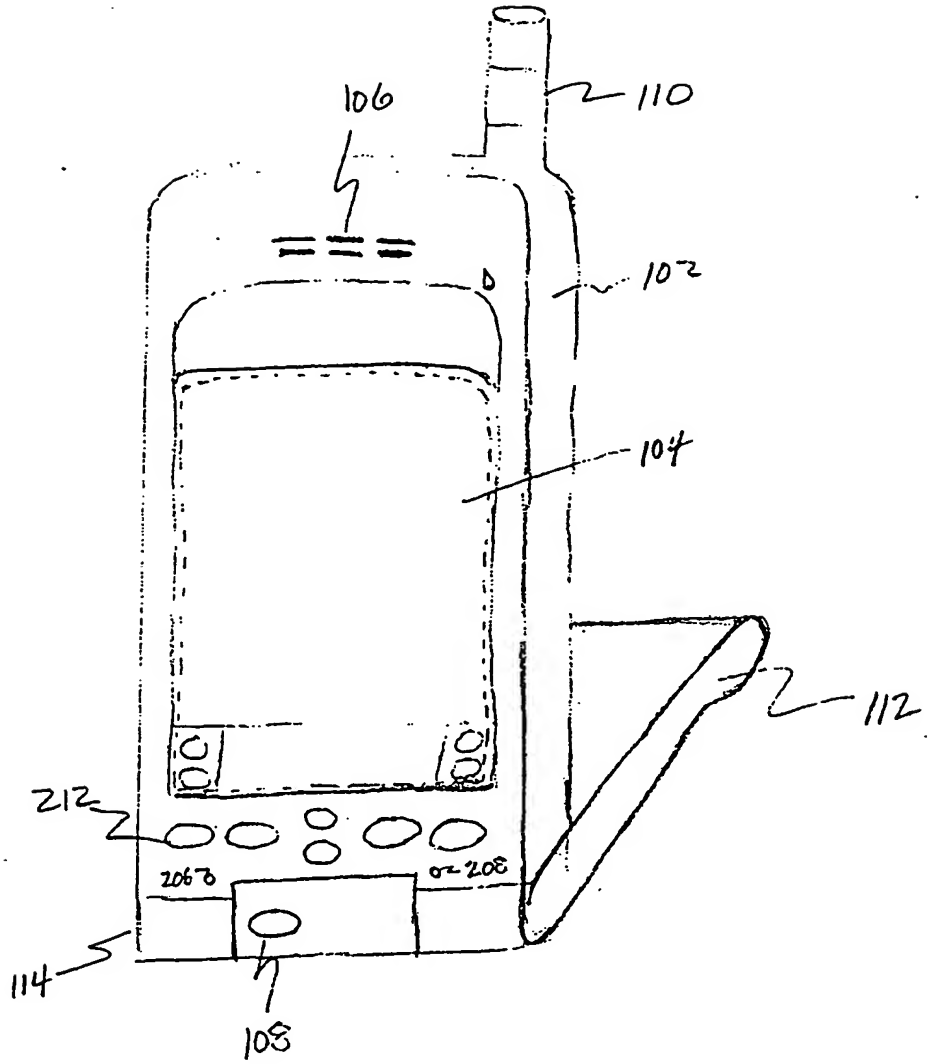
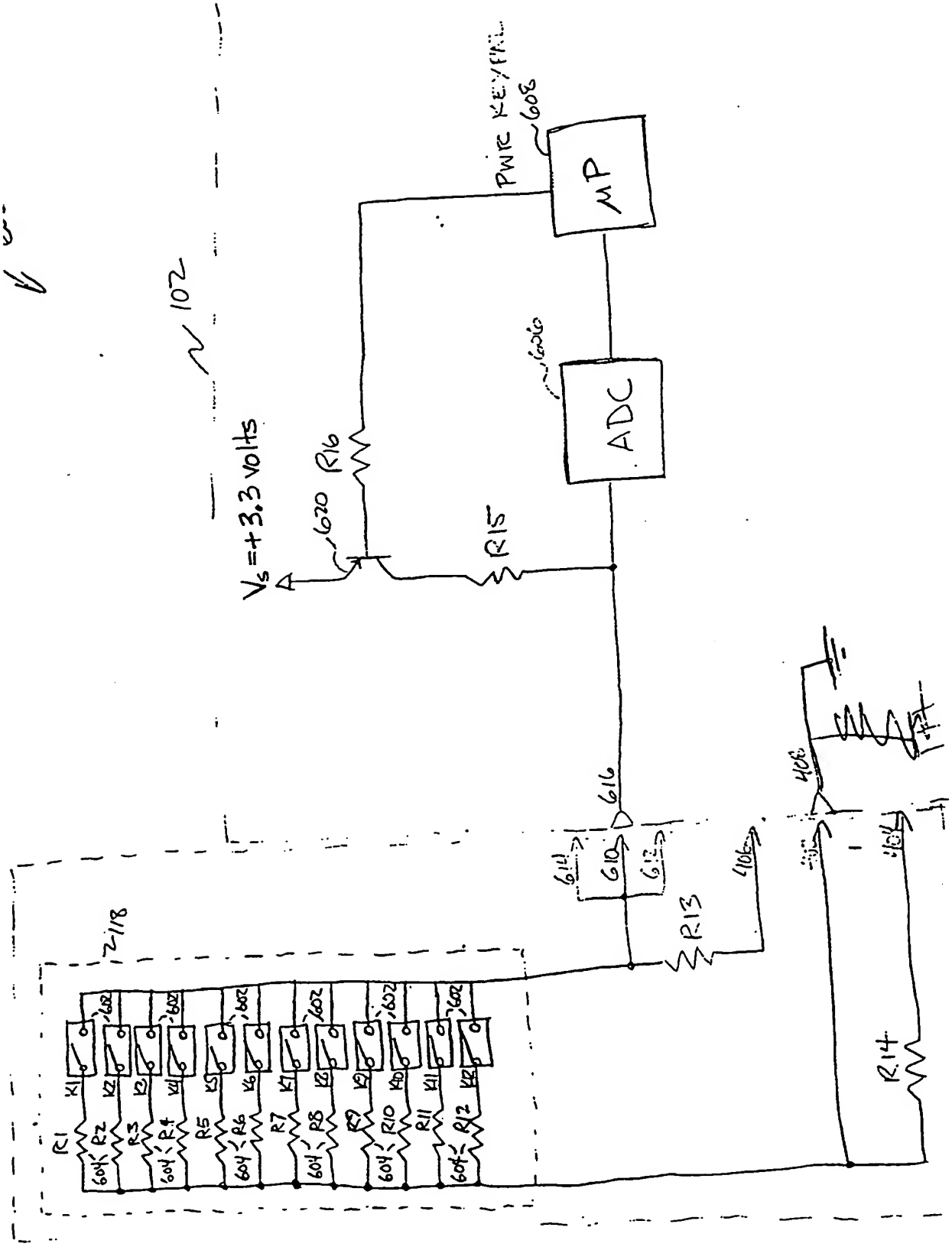


FIG 5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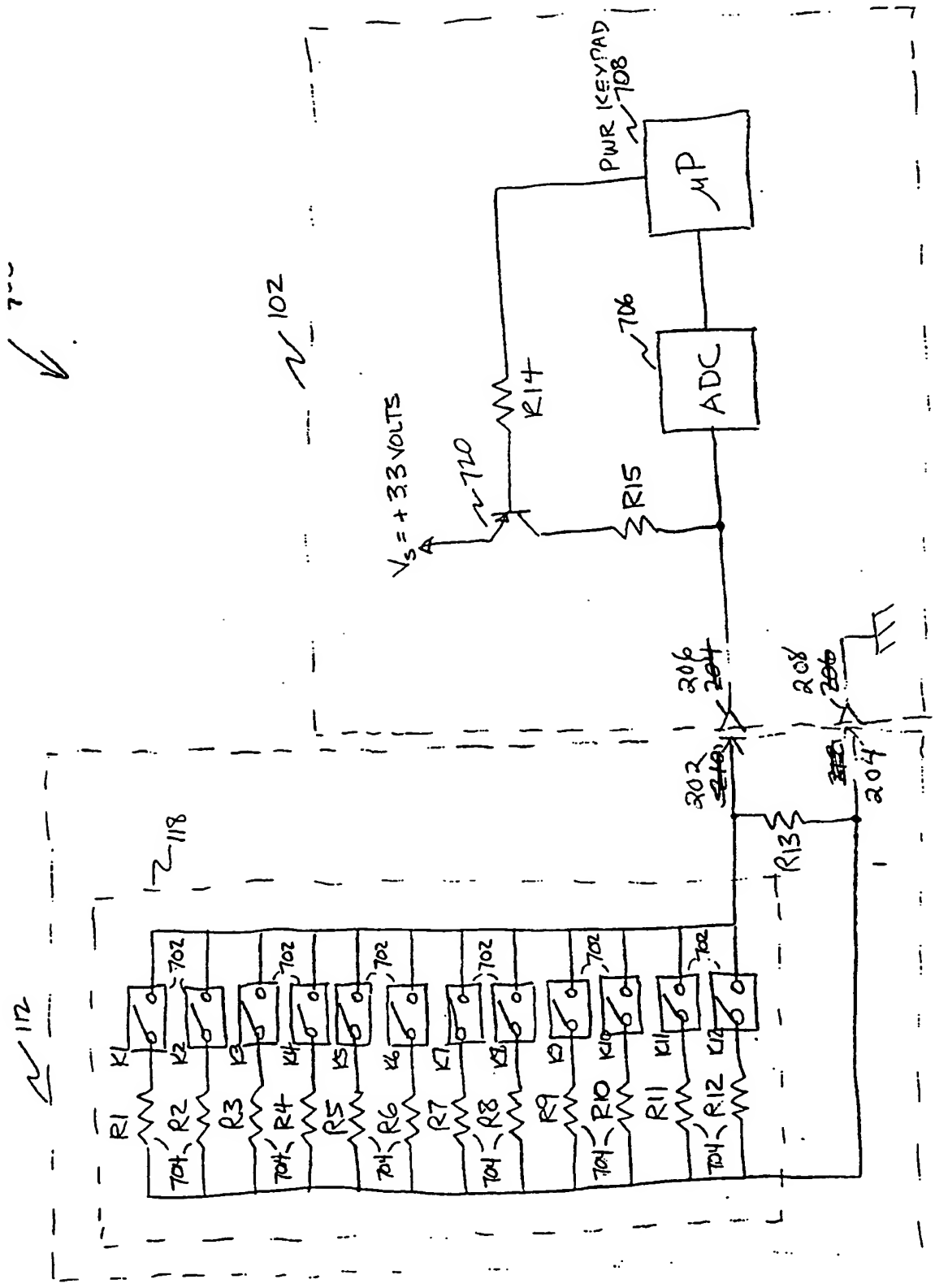
PWR KEY/FB
606
MP
ADC
608
V_S = +3.3 volts
620
R16
R15
616
614
610
612
R13
406
408
410
R14
118
602
604
K1
K2
K3
K4
K5
K6
K7
K8
K9
K10
K11
K12
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12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102
PWR KEYPAD
708
μP
706
ADC
R14
720
V_S = +3.3 VOLTS
R15
206
204
208
202
R13
118
112
K1
K2
K3
K4
K5
K6
K7
K8
K9
K10
K11
K12
702
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
704

INTERNATIONAL SEARCH REPORT

Int. ional Application No
PCT/US 00/12231

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04M1/02 H04M1/725

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98 19434 A (ERICSSON GE MOBILE INC) 7 May 1998 (1998-05-07) page 3, line 23 -page 8, line 8 figures 3,5	1-14
A	EP 0 898 223 A (LUCENT TECHNOLOGIES INC) 24 February 1999 (1999-02-24) column 2, line 15 -column 3, line 6 figures 1A,1B	1-14
A	EP 0 472 361 A (NOKIA OY AB) 26 February 1992 (1992-02-26) column 1, line 18 - line 31	1-14

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
28 August 2000	06/09/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl. Fax: (+31-70) 340-3016	Vaucois, X

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. Jonal Application No
PCT/US 00/12231

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		JP 11149266 A	02-06-1999
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